

Rock and Fracture Characterization of the Woodford Shale Along the I-35 Outcrop and Nearby Wells

Henry Galvis, Daniela Becerra-Rondon, D. Duarte, and Roger Slatt

University of Oklahoma

Abstract

Lately, the Upper Devonian-Lower Mississippian Woodford Shale is the most attractive unconventional resource play in Oklahoma. Particularly, in the southern flank of the Arbuckle uplift, the Woodford Shale crops out along a SE-NW belt that extends from Johnston County, through the type section in Carter and Murray counties. It thickens southward into the Ardmore Basin, where hundreds of wells have proved the oil/gas potential of this unit.

A road-cut exposure along the west side of Interstate-35 provides an excellent opportunity to examine in detail the lithological heterogeneities and the naturally fractured systems present in the uppermost 80 feet of the Woodford Shale. On this location, lithologies consist mostly of dark-colored, organic-rich and fine-grained rocks, stacked vertically in thin cycles (2-10 cm) of highly indurated cherty beds and fissile shales, along with few scattered dolomitic and silty beds. Very well developed phosphate nodules and nodular beds are abundant throughout this section.

Detailed fracture analysis was conducted on every single bed (700 beds), recording its number of fractures (perfect bed-bounded), bed thickness, joint spacing, fracture filling material, and weathering response ('hard' or 'soft'). Two well defined and conjugate fracture sets were recognized. Fractures patterns are better developed in 'hard' beds, they are abundant and perpendicular to the bedding, and scarce and irregular in 'soft' beds. Many fractures die-out within the 'soft' beds, however few fractures go through both 'hard' and 'soft' beds. Also, there is a direct correlation between fracture spacing and bedding thickness at least in the 'hard' beds, thicker beds showed lesser number of fractures.

Comparisons between outcrop-based radioactivity profiles and subsurface Gamma Ray logs reveal many similarities, reflecting a relatively good lateral and vertical continuity, meaning low rock variability between outcrops and subsurface.